



Brine-Re-cooler

Do you belong to the companies, that manufacture serial brine re-coolers for dry, adiabatic and hybrid operation? Such as:

- www.luve.it
- www.cabero.de
- www.guentner.de
- www.karyergroup.com

By this means not only the production of finned heat exchangers, but also compact units consisting of finned heat exchangers, humidification systems, drip trays, fans, inspection doors, support structures and electrical connection boxes.



If you can answer yes to the question above, then you know the associated problem that the development department has to solve using the following example for complete series of units:

- First, 2 finned heat exchangers must be designed for a capacity of 1,200 kW with a target air volume of 300,000 m³/h.
- Then 16 suitable axial fans must be evaluated, which together have approximately the desired air volume in relation to the pressure drop of the finned heat exchanger.
- Finally, the exact point of intersection between the characteristic curves of the fans and the finned heat exchanger must be determined by multiple manual iterations.

If your development engineers are under-employed, you don't need our software **ESH**, which could do this work in a fraction of the time. Otherwise we recommend that you contact us asap.

Macro

Calculation time < 10 seconds

WAHR	0.077	% Surface reserve
WAHR	0.00	Difference (Pa)

Selection	Type
3	Hybrid
1	dry
2	Adiabatic
3	Hybrid

Finned width mm
1250

Selection	Type	Fan Piece	Finned width mm	Speed %
8	V-2x8	16	10000	
1	V-2x1	2	1250	100.00
2	V-2x2	4	2500	89.75
3	V-2x3	6	3750	79.50
4	V-2x4	8	5000	69.25
5	V-2x5	10	6250	59.00
6	V-2x6	12	7500	48.75
7	V-2x7	14	8750	38.50
8	V-2x8	16	10000	28.25
				18.00

Selection	Product	Type	Sound power dB(A)	Speed rpm	Capacity W
1	Ziehl-Abegg	FE80-SD.6N.V7.Δ	84.00	900.00	1800.00
1	Ziehl-Abegg	FE80-SD.6N.V7.Δ	84.00	900.00	1800.00
2	Ziehl-Abegg	FE80-SD.6N.V7.Y	78.00	700.00	1175.00
3	Ziehl-Abegg	FE80-AD.6N.V7.Δ	78.00	690.00	945.00
4	Ziehl-Abegg	FE80-AD.6K.V7.Δ	76.00	650.00	845.00
5	Ziehl-Abegg	FE80-AD.6N.V7.Y	72.00	565.00	700.00
6	Ziehl-Abegg	FE80-ND.6K.V7.Δ	67.00	450.00	340.00
7	Ziehl-Abegg	FE80-AD.6K.V7.Y	66.00	435.00	455.00
8	Ziehl-Abegg	FE80-ND.6K.V7.Y	64.00	355.00	190.00
9	???	???	0.00	0.00	0.00
10	???	???	0.00	0.00	0.00

In the **ESH** software, the characteristic curves for the air volume as a function of the pressure, each with 6 support points, can be stored as the basis for a spline interpolation for the fans. The characteristic curve of the finned heat exchanger results automatically from their calculation. The intersection point is determined within a few seconds using a macro in the Excel-based application, which can be purchased unprotected or protected.

Page 2: Complete data overview

Page 3: Hybrid design of the heat exchanger for summer below 32°C

Page 4: Dry design for winter and the transitional period below 17°C

Page 5: Profitability, operating and energy costs per year for the Zurich location

Page 6: Economics, payback period, comparison to an open cooling tower

Hybrid-Re-Cooler V-2x8 - Offer no. 13285

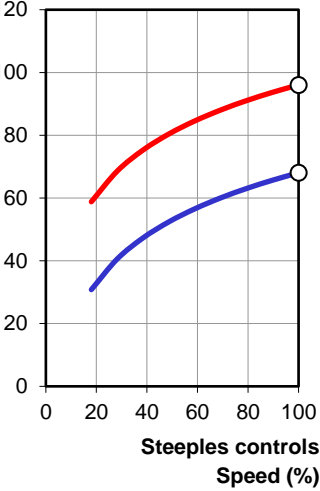
Company	Schenkel & Partner GmbH	
Branch	Ingenieurbüro	
Street	Bahnhofstrasse 44	
Country/ZIP/City	8000 Zürich	
Installation	Credit Suisse	
Project	Zentrale Kälte	
Project leader	P. Kaltenrieder	
Altitude	m	450.000
Pressure	hPa	960.075
Capacity	kW	1200.000
Present surface	m ²	4387.787
Sound power	dB(A)	96.041
Periphery	m	10.000
Sound pr.	dB(A)	68.041
Volume flow humid	m ³ /h	312185.998
Definition: Temp.	°C	20.000
Definition: Rel. humidity	%	40.000

Fan	Piece	16.000
Volume flow	m ³ /h	312185.998
Heat exchanger	%	95.000
Box	%	5.000
Heat exchanger	Pa	103.449
Box	Pa	5.445
Length	mm	10478.000
Width	mm	2300.000
Altitude	mm	2250.000
Weight empty	kg	5238.000
Volume	kg	1172.000
Weight total	kg	6410.000

Fan: Ziehl-Abegg	Type	FE80-SD.6N.V7.Δ
Diameter	mm	800.000
Speed	rpm	900.000
Sound power	dB(A)	84.000
Capacity (~400V-3.70A-50Hz)	W	1800.000
Volume flow	m ³ /h	19511.625
Static pressure	Pa	108.894

30 V% Et.glycol	m³/h	188.153
Temp. in	°C	34.000
Temp. out	°C	28.000
Pressure drop	kPa	29.755
Connections //	mm	2 x NW150

Sound power (dB(A))
Sound pr. (dB(A))

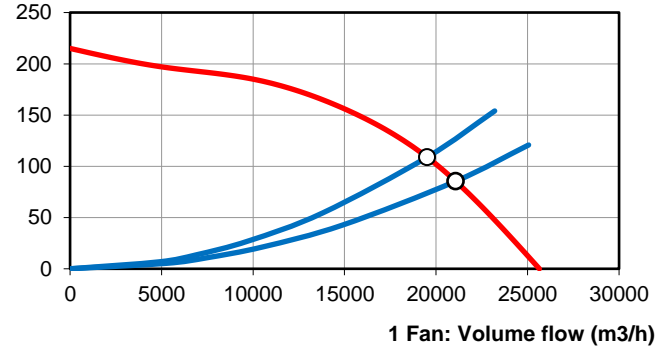


Company
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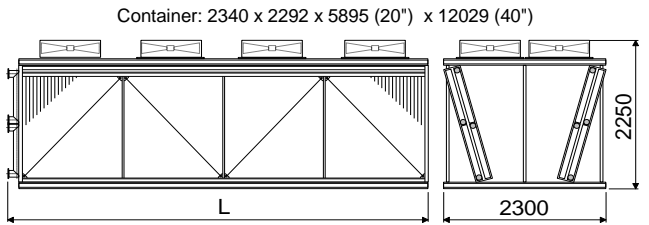
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Static pressure (Pa)
Pressure drop (Pa)

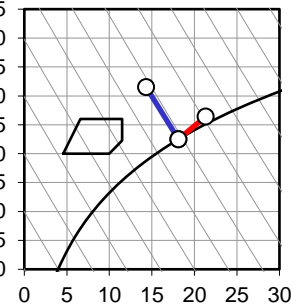


Software by www.zcs.ch



Water demand total: 95.13 % less than an open-cooling-tower !

Air	Inlet	---	Outlet	
Temp.	°C	31.500	22.489	26.423
Rel. humidity	%	46.930	100.000	92.568
Abs. humidity	g/kg	14.332	18.121	21.321
Density humid	kg/m ³	1.088	1.119	1.102
Enthalpy humid	kJ/kg	68.379	68.696	80.946
Mass flow dry	kg/h	352645.926	352645.926	352645.926
Volume flow humid	m ³ /h	328678.923	320856.148	326750.037
Humidification	°C		20.000	
Humidification	m ³ /h		2.464	
Humidification (Max.)	m ³ /h		2.813	



Indication	Piece	Remarks	Weight	EUR
Heat exchanger	2	Type 40/35/16-6R-44T-10000A-3.0PA-132C	2662	62660.00
Pump 3.095 m ³ /h	1	Humidification 2.813 - Waste water 0.281 m ³ /h	238	19190.00
Fan, motor à 1800.00 W	16	Ziehl-Abegg, FE80-SD.6N.V7.Δ	736	8220.00
Construction type	1	Galvanized	1502	33190.00
Steeple controls	1	Basic equipment, controls	100	18490.00
Delivery	9-10 weeks	Total	5238	141750.00
Validity	12 weeks	Discount 5.00 %		7088.00
Conditions	net, prepaid address			
Payment	30 days net	Price net:		134662.00

Type 40/35/16-6R-44T-10000A-3.0PA-132C

Capacity	kW	600.000	----- sensible:	200.461
Surface reserve	%	0.077	latent:	399.539
Present surface	m2	2193.893		
Required surface	m2	2192.197		
k-coeff.	W/m2K	43.097	----- ffi:	5.000E-05
Average temp. diff. (97.87 %)	K	6.351	ffa:	5.000E-05



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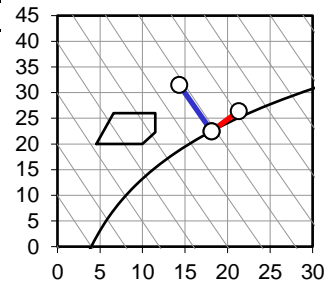
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Air humid		Inlet	Outlet	Definition
Height over sea level	m			450.000
Pressure	hPa			960.075
Temp. (31.500)	°C	22.489	26.423	20.000
Rel. humidity (46.930)	%	100.000	92.568	40.000
Abs. humidity (14.332)	g/kg	18.121	21.321	
Density humid	kg/m3	1.119	1.102	
Enthalpy humid	kJ/kg	68.696	80.946	
Volume flow humid	m3/h	160428.074	163375.018	156092.999
Mass flow dry	kg/h	176322.963	176322.963	
Velocity	m/s	2.532	2.579	
Pressure drop (dry 72 Pa)	Pa		103.448	
Humidification	°C	20.000		
Humidification	m3/h		2.464	

30 V% Et.glycol		Inlet	Outlet	Average
Temp.	°C	34.000	28.000	31.000
Density	kg/m3			1040.834
Spec. heat	kJ/kgK			3.677
Heat cond.	W/mK			0.465
Viscosity	Pas			1.652E-03
Volume flow	m3/h			94.077
Velocity	m/s			1.036
Pressure drop	kPa			29.755

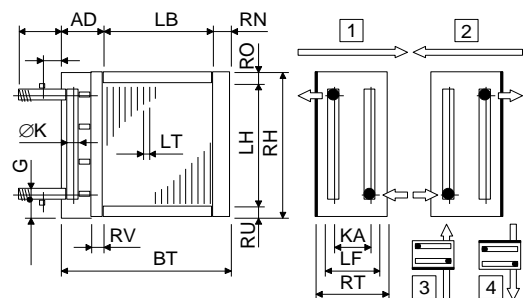


Technical data

Tubes total	Piece	264
Tubes blank	Piece	0
Internal venting	Piece	0
Internal drains	Piece	0
Tube rows on the depth	Piece	6
Tube rows on the height	Piece	44
Tube coupling in series	Piece	2
Number of circuits (NC)	Piece	132
Volume	l	586
Weight	kg	1331
Connections	G	--- NW150
Frame height	RH	mm 1840
Frame width	BT	mm 10328
Frame depth	RT	mm 390
Finned height	LH	mm 1760
Finned width	LB	mm 10000
Finned depth	LF	mm 208
Frame on top	RO	mm 40
Frame on bottom	RU	mm 40
Frame in front	RV	mm 30
Frame on back (~69mm)	RN	mm 69
Collector-Diameter	K	mm 168
Collector covering	AD	mm 259
Collector distance	KA	mm 189
Fin spacing	LT	mm 3.000
Fin thickness	LD	mm 0.200
Tube diameter	DA	mm 16.400
Tube thickness	S	mm 0.400
Tube interval on the height	S1	mm 40.000
Tube interval on the depth	S2	mm 34.641

Tubes:	smooth	Cu+8µSn
	staggered	
Collectors:	1.35 m/s	Cu+8µSn
Connections:	1.35 m/s	Rg7
Fins:	smooth	AlMg3
Frame:	2.00 mm	AISI 304
Circulations:	1	Standard
Protection:		without

Air flow direction: horizontal
Special: Bottom plate perforated for perfect condensate drain



Delivery:	9-10 weeks
Validity:	12 weeks
Condit.:	net, prepaid address
Payment:	30 days net
Price net:	EUR 31330.00

Type 40/35/16-6R-44T-10000A-3.0PA-132C

Capacity	kW	600.001		
Surface reserve	%	0.001		
Present surface	m2	2193.893		
Required surface	m2	2193.876		
k-coeff.	W/m2K	36.332	----- ffi:	5.000E-05
Average temp. diff. (95.72 %)	K	7.527	ffa:	5.000E-05



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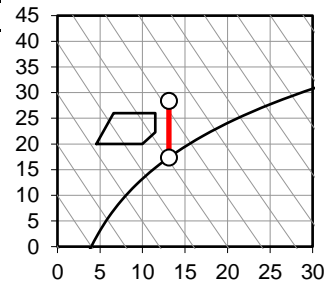
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Air humid		Inlet	Outlet	Definition
Height over sea level	m			450.000
Pressure	hPa			960.075
Temp.	°C	17.372	28.374	20.000
Rel. humidity	%	100.000	51.426	40.000
Abs. humidity	g/kg	13.104	13.104	
Density humid	kg/m3	1.142	1.100	
Enthalpy humid	kJ/kg	50.668	62.012	
Volume flow humid	m3/h	168910.529	175306.959	168561.708
Mass flow dry	kg/h	190407.641	190407.641	
Velocity	m/s	2.666	2.767	
Pressure drop	Pa		81.146	

Software by www.zcs.ch

30 V% Et.glycol		Inlet	Outlet	Average
Temp.	°C	34.000	28.000	31.000
Density	kg/m3			1040.834
Spec. heat	kJ/kgK			3.677
Heat cond.	W/mK			0.465
Viscosity	Pas			1.652E-03
Volume flow	m3/h			94.077
Velocity	m/s			1.036
Pressure drop	kPa			29.756

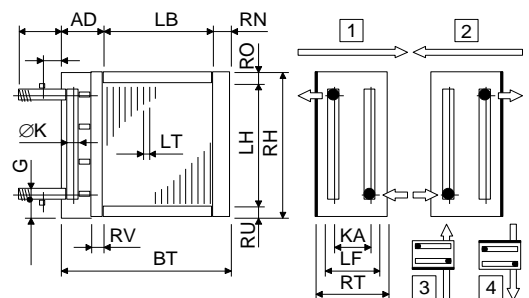


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Finned depth	LF	mm 208
Frame on top	RO	mm 40
Frame on bottom	RU	mm 40
Frame in front	RV	mm 30
Frame on back (~69mm)	RN	mm 69
Collector-Diameter	K	mm 168
Collector covering	AD	mm 259
Collector distance	KA	mm 189
Fin spacing	LT	mm 3.000
Fin thickness	LD	mm 0.200
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Tubes:	smooth	Cu+8µSn
	staggered	
Collectors:	1.35 m/s	Cu+8µSn
Connections:	1.35 m/s	Rg7
Fins:	smooth	AlMg3
Frame:	2.00 mm	AISI 304
Circulations:	1	Standard
Protection:		without

Air flow direction: horizontal
Special: Bottom plate perforated for perfect condensate drain



Delivery:	9-10 weeks
Validity:	12 weeks
Condit.:	net, prepaid address
Payment:	30 days net
Price net:	EUR 31330.00

Economy

Water demand total: 95.13 % less than an open-cooling-tower !

Year: 8760 Hours



Station	Water	Year: 8760 Hours					
		Day	Night	Temp.	Day	Night	
Zürich (1995-2005)	kg/h	t/a	t/a	°C	h	h	
	0.0	0.0	0.0	40.5	0.0	0.0	
	0.0	0.0	0.0	39.5	0.0	0.0	
	0.0	0.0	0.0	37.5	0.0	0.0	
Capacity	kW	1200.00	0.0	0.0	38.5	0.0	0.0
			0.0	0.0	37.5	0.0	0.0
30 V% Et.glycol	h	8760.00	0.0	0.0	36.5	0.0	0.0
Temp. in	°C	34.00	0.0	0.0	35.5	0.0	0.0
Temp. out	°C	28.00	0.0	0.0	34.5	0.0	0.0
Volume flow	m3/h	188.15	2813.3	7.7	33.5	2.8	0.0
Mass flow	kg/h	97918.23	2638.9	14.5	32.5	5.5	0.0
Pressure drop	kPa	29.76	2464.4	16.6	31.5	6.8	0.5
Ext. pressure	kPa	50.00	2290.0	18.3	30.5	8.0	1.0
Pressure drop total	kPa	79.76	2115.6	39.7	29.5	18.8	2.8
Pump-Efficiency	%	80.00	1941.1	57.3	28.5	29.5	4.5
Pump power	kW	5.21	1766.7	61.0	27.5	34.5	8.0
Energy costs	EUR	2875.58	1592.3	62.9	26.5	39.5	11.5
			1417.8	83.7	25.5	59.0	14.0
Wet-Service (21.56%)	h	1888.25	1243.4	97.6	24.5	78.5	16.5
Temp.	°C	31.50	1069.0	117.1	23.5	109.5	27.0
Rel. humidity	%	46.93	894.5	125.7	22.5	140.5	37.5
Abs. humidity	g/kg	14.33	720.1	105.5	21.5	146.5	57.5
Air humid (20°/40%)	m3/h	312186.00	545.7	83.2	20.5	152.5	77.5
Mass flow dry	kg/h	352645.93	371.2	56.2	19.5	151.3	93.5
Pressure drop	Pa	103.45	196.8	29.5	18.5	150.0	109.5
Box	Pa	5.44	22.4	3.6	17.5	163.0	131.0
Ext. pressure	Pa	0.00	0.0	0.0	16.5	176.0	152.5
Pressure drop total	Pa	108.89	0.0	0.0	15.5	187.8	162.8
Fan-Efficiency	%	32.79	0.0	0.0	14.5	199.5	173.0
Fan power	kW	28.80	0.0	0.0	13.5	190.0	186.8
Energy costs	EUR	3426.04	0.0	0.0	12.5	180.5	200.5
			0.0	0.0	11.5	171.5	215.8
			0.0	0.0	10.5	162.5	231.0
Humidifier (21.56%)	h	1888.25	0.0	0.0	9.5	159.3	226.3
Temp.	°C	20.00	0.0	0.0	8.5	156.0	221.5
Humidification	kg/h	2464.43	0.0	0.0	7.5	163.8	210.5
Humidification (Max.)	kg/h	2813.30	0.0	0.0	6.5	171.5	199.5
Pressure drop	kPa	200.00	0.0	0.0	5.5	167.8	207.5
Pump-Efficiency	%	80.00	0.0	0.0	4.5	164.0	215.5
Pump power	kW	0.21	0.0	0.0	3.5	146.8	211.3
Energy costs	EUR	25.57	0.0	0.0	2.5	129.5	207.0
Day + 10% Waste water	t/a	1078.01	0.0	0.0	1.5	124.8	179.8
Night + 10% Waste water	t/a	325.80	0.0	0.0	0.5	120.0	152.5
Total + 10% Waste water	t/a	1403.82	0.0	0.0	-0.5	96.0	128.3
Water	EUR	5615.27	0.0	0.0	-1.5	72.0	104.0
			0.0	0.0	-2.5	50.8	71.3
			0.0	0.0	-3.5	29.5	38.5
			0.0	0.0	-4.5	20.8	29.0
			0.0	0.0	-5.5	12.0	19.5
			0.0	0.0	-6.5	12.0	16.0
			0.0	0.0	-7.5	12.0	12.5
			0.0	0.0	-8.5	6.5	8.5
			0.0	0.0	-9.5	1.0	4.5
			0.0	0.0	-10.5	0.5	2.3
			0.0	0.0	-11.5	0.0	0.0
			0.0	0.0	-12.5	0.0	0.0
			0.0	0.0	-13.5	0.0	0.0
			0.0	0.0	-14.5	0.0	0.0
			0.0	0.0	-15.5	0.0	0.0
			0.0	0.0	-16.5	0.0	0.0
			0.0	0.0	-17.5	0.0	0.0
			0.0	0.0	-18.5	0.0	0.0
			0.0	0.0	-19.5	0.0	0.0
			0.0	0.0	-20.5	0.0	0.0
			0.0	0.0	-21.5	0.0	0.0
			0.0	0.0	-22.5	0.0	0.0
			0.0	0.0	-23.5	0.0	0.0
			0.0	0.0	-24.5	0.0	0.0
			0.0	0.0	-25.5	0.0	0.0
			0.0	0.0	-26.5	0.0	0.0
			0.0	0.0	-27.5	0.0	0.0
			0.0	0.0	-28.5	0.0	0.0
			0.0	0.0	-29.5	0.0	0.0
			0.0	0.0	-30.5	0.0	0.0
Service - Energy costs							
Daily hours (100.00%)	h/a	4380.00	0.0	0.0	-17.5	0.0	0.0
Night hours (100.00%)	h/a	4380.00	0.0	0.0	-18.5	0.0	0.0
Electric energy (MWh)	EUR	63.00	0.0	0.0	-19.5	0.0	0.0
Water (t)	EUR	4.00	0.0	0.0	-20.5	0.0	0.0
Life cycle	Years	15.00	0.0	0.0	-21.5	0.0	0.0
Support costs	%	5.00	0.0	0.0	-22.5	0.0	0.0
Capital interest	%	4.00	0.0	0.0	-23.5	0.0	0.0
Energy increase	%	2.00	0.0	0.0	-24.5	0.0	0.0
Inflation	%	2.00	0.0	0.0	-25.5	0.0	0.0
Investment costs	EUR	134662.00	0.0	0.0	-26.5	0.0	0.0
Water + Energy costs	EUR	24410.56	0.0	0.0	-27.5	0.0	0.0
Support costs	EUR	6733.10	0.0	0.0	-28.5	0.0	0.0
Overheads	EUR	31143.66	0.0	0.0	-29.5	0.0	0.0
			0.0	0.0	-30.5	0.0	0.0
Capital costs	EUR	71874.57	2813.3	980.0	296.2	4380.0	4380.0

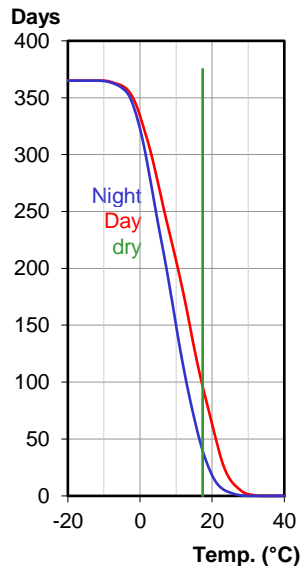
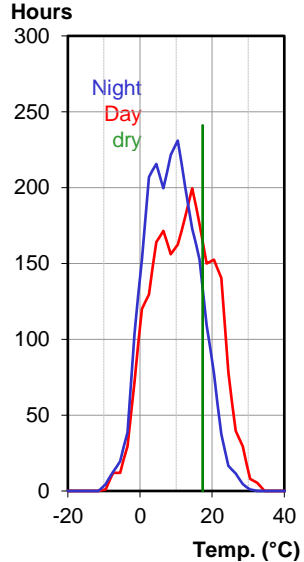
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Economy

Capital interest	%	4.00
Energy increase	%	3.00
Inflation	%	2.00
Support costs	%	5.00

Investment costs

Open cooling tower	EUR	63000.00
Hybrid-Re-Cooler	EUR	134662.00
Additional costs	EUR	71662.00

Overheads

Support costs (+)	EUR	3583.10
Energy costs: Open cooling tower (-)	EUR	120000.00
Energy costs: Hybrid-Re-Cooler (+)	EUR	24410.56
Energy costs: - 79.7 %	EUR	95589.44

Amortization

BEP (Break even point)	Years	1.58
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Company
Branch
Street
Country / ZIP / City

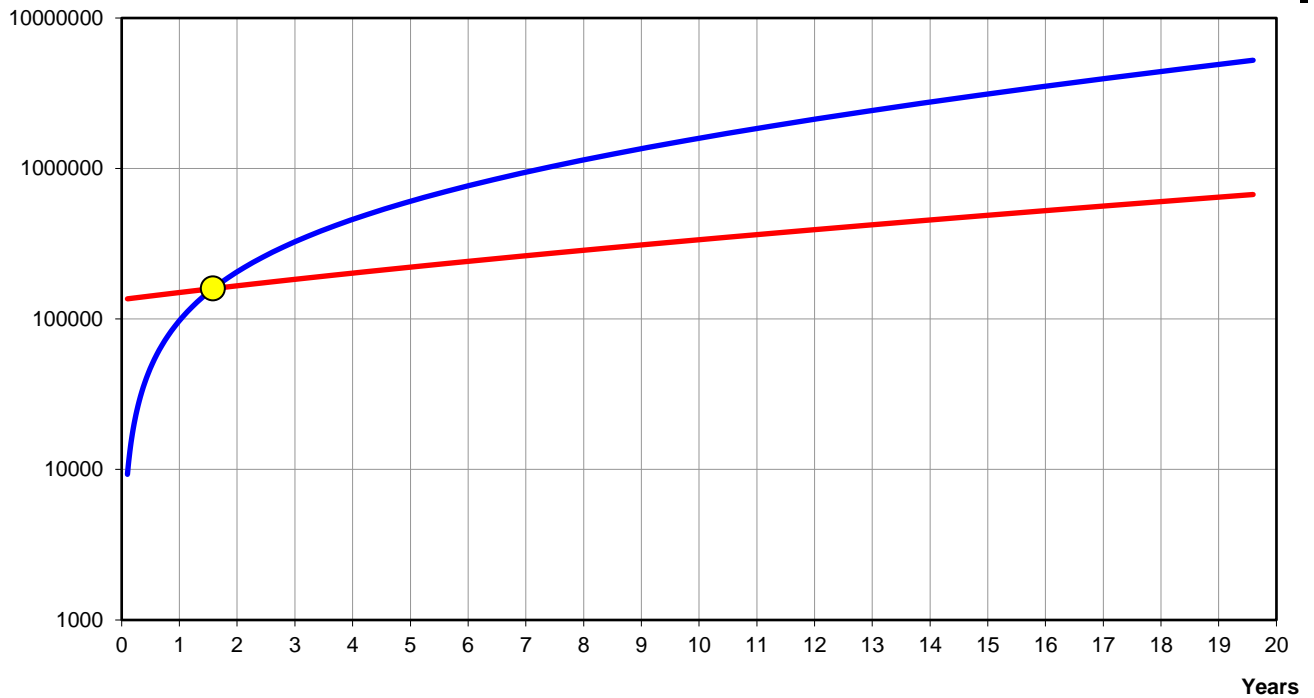
Phone: xxxxxxxxx
Fax: xxxxxxxxx
E-Mail
Homepage

City, 04.04.2022
With the compliments of

Representative
Direct dialing
xxxxxxxxxx

Incomes (EUR) - Expenses (EUR)

Software by www.zcs.ch



Humidifiers - Fresh water

Pressure 2 to 16 bar
pH 6 to 8
Hardness < 3 °fH
Chloride < 20 mg/l
Conduc. < 800 µS/cm

Counteragent to corrosion and anorg. deposits
Counteragent to micro organism and algae growth
Desalination plant with conductance writer

Hybrid-Re-Cooler

